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Achieving Data Quality within the Logistics Modernization Program

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September 2012

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The Joint Munitions Command (JMC) provides bombs and bullets to U.S. forces—all Services and all types of conventional ammunition from bunker-buster bombs to rifle rounds. The JMC manages the plants that produce more than 1.6 billion rounds of ammunition annually and the depots that store the nation’s ammunition for training and combat. The JMC is currently accountable for $30 billion of munitions and missiles. For about 30 years the JMC used the Commodity Command Standard System to manage its inventory and the Standard Depot System to administer depot-level maintenance operations. In 1999 the JMC initiated an effort to replace those antiquated systems with the Logistics Modernization Program (LMP), an enterprise resource planning system that held the promise of reducing inventory, improving forecast planning for supply and demand, and providing a single source of data for decision-making by transforming logistics operations in six core processes: order fulfillment, supply and demand planning, procurement, asset management, materiel maintenance, and financial management. In 2010 the JMC finally fielded the LMP. However, a variety of factors have prevented the JMC from fully benefiting from the LMP’s promised functionality, especially the fight to achieve and maintain data quality.

This study examines published data quality records to identify data quality patterns or trends that exist in component organizations of the JMC and links them to strategies for reducing data defects. The findings and implications of this study are discussed.

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ACHIEVING DATA QUALITY WITHIN THE LOGISTICS MODERNIZATION PROGRAM

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Submitted in partial fulfillment of the requirements for the degree of

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Achieving Data Quality within the Logistics Modernization Program

ABSTRACT

The Joint Munitions Command (JMC) provides bombs and bullets to U.S. forces—all Services and all types of conventional ammunition from bunker-buster bombs to rifle rounds. The JMC manages the plants that produce more than 1.6 billion rounds of ammunition annually and the depots that store the nation's ammunition for training and combat. The JMC is currently accountable for $30 billion of munitions and missiles. For about 30 years the JMC used the Commodity Command Standard System to manage its inventory and the Standard Depot System to administer depot-level maintenance operations. In 1999 the JMC initiated an effort to replace those antiquated systems with the Logistics Modernization Program (LMP), an enterprise resource planning system that held the promise of reducing inventory, improving forecast planning for supply and demand, and providing a single source of data for decision-making by transforming logistics operations in six core processes: order fulfillment, supply and demand planning, procurement, asset management, materiel maintenance, and financial management. In 2010 the JMC finally fielded the LMP. However, a variety of factors have prevented the JMC from fully benefiting from the LMP's promised functionality, especially the fight to achieve and maintain data quality.

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LIST OF ACRONYMS AND ABBREVIATIONS

JMC	Joint Munitions Command
LMP	Logistics Modernization Program
LOGSA	Logistics Support Activity
BOM	Bills of Material
AIS	Automated Information Systems
GAO	Government Accountability Office
BL	Blended Learning
F2F	Face-to-Face
CBT	Computer-Based Training
ARFORGEN	Army Force Generating Model
TRADOC	United States Army Training and Doctrine Command
ALC2015	Army Learning Concept 2015
POIs	Programs of Instruction
ERP	Enterprise Resource Planning
QDR	*Quadrennial Defense Review*
DRI	*Defense Reform Initiative*
AMC	Army Materiel Command
CECOM	Communications-Electronics Command
CCSS	Commodity Command Standard System
SDS	Standard Depot System
GSA	General Services Administration
BPO	Business Process Owner

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Now to my dearest friend, the King-Eternal, immortal, invisible, the only God be my deepest gratitude and love that I hope will last throughout the ages.

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I. INTRODUCTION

The importance of this project is tied to the notion that data is as important as ammunition. In the same way that faulty ammunition can bring a ruinous outcome to an otherwise perfect mission, poor data quality can lead to disastrous results. Conversely, accurate data can lay the foundation for smarter decision-making at all levels of an organization. Good data is especially critical in the business of logistics—a primary activity within the Joint Munitions Command (JMC).

The author's efforts in researching this thesis focused on data quality measurements obtained from the JMC Enterprise Integration Data Team, which has been charged with creating and publishing accuracy measurements for all critical data objects and with establishing consistent business rules to be applied and communicated to all sites within the JMC. These sites include Letterkenny Munitions Center, Blue Grass Army Depot, McAllister Army Ammunition Plant, Tooele Army Depot, Crane Army Ammunition Activity, and Pine Bluff Arsenal. Although regularly scheduled audits are performed by the cognizant business process owners at each of the JMC component organizations on a variety of production-related business elements (such as routes, planographs, bills of material, etc.), the author has limited the scope of this study to audits of bills of material (BOM) data.

A. PURPOSE OF RESEARCH

The author's purpose in this study was to determine the existence of data quality patterns or trends in component organizations of the JMC. In order to make this determination, the author studied data quality records of the various JMC components and qualified the data defects by category. Based on the data qualifications, the author was able to make strategic recommendations for reducing data defects across the JMC enterprise.

B. RESEARCH QUESTIONS

In order to accomplish the goal of this research, three major questions must be answered:

- Can the data quality data be qualified in any meaningful way?
- Are there data quality trends or patterns that exist within the JMC?

- Can a strategy be applied that will reduce data defects across the JMC enterprise?

C. BENEFITS OF THE RESEARCH

Today's U.S. armed forces rely heavily on information to win the fight in a battle space that encompasses land, air, sea, space, and now cyberspace. The Pentagon has invested tens of billions of dollars in automated information systems (AISs) to gather, store, process, and disseminate mission-critical information. The LMP is the U.S. Army's latest AIS, and its purpose is to manage the key logistical needs of the Department of Defense (DoD). The JMC is deeply involved in that logistics mission by providing conventional ammunition to the Army, Navy, Air Force, and Marines, and it seeks to leverage the LMP to optimize its capabilities by placing the lowest possible burden on taxpayers. However, the LMP is only as useful as the data it possesses. With so much riding on the viability of the LMP, achieving and maintaining quality data is imperative. The author's primary aim in this research is to increase understanding about how the JMC can improve its business processes to properly manage data quality and realize the full potential of what the LMP can do.

D. LIMITATIONS OF THE RESEARCH

The JMC collects data quality measurements on several business elements across its enterprise. Assuming that the organizational processes are the same for each business element, performing an analysis of each business element would be superfluous. For this reason the author chose to examine only one element: the BOM. Additionally, since the JMC has only been fielded with the LMP since October 2010, the amount of audit data is limited in depth.

E. METHODOLOGY

The author began this research by contacting the director of the JMC Enterprise Integration Data Team and requesting access to the team's SharePoint server. With this access, the author downloaded the data quality scorecards from previous audits of the major commands within the JMC. The author did not know of the existence of this data at the beginning of this project, and it was helpful in furthering this research. The data served as a means of quantifying the accuracy of BOM records and provided insight into the immediate causes of defective data. The author then categorized these causes as training, policy, or process related in order to develop strategies for reducing the data defects.

F. ORGANIZATION OF THE REPORT

This joint applied project is composed of five chapters. Chapter I contains the purpose of the research, the research questions, the benefits of the research, the limitations of the research, and the research methodology. Chapter II is a literature review in which the author touches on training issues raised by a GAO report and then discusses documentation and research published with regards to innovative approaches to training, which this study finds is a factor in improving data quality. In Chapter II the author also presents an overview of the various missions of the JMC component organizations, background on the LMP, an overview of data quality, and the methodology of conducting an audit. In Chapter III the author presents the scorecard and audit data. In Chapter IV the author provides analysis of this data. In Chapter V the author summarizes the findings and provides recommendations.

G. SUMMARY

In this chapter the author provided an overview of what this project seeks to accomplish and tried to convince the reader of how important data quality is to the mission of the JMC and to the U.S. armed forces at large. In the next chapter the author presents a literature review and the background information necessary to highlight the importance of this subject matter.

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II. LITERATURE REVIEW

A. INTRODUCTION

The GAO is an independent agency of the U.S. government that performs investigations on other agencies of the federal government. One of the GAO's specific purposes is to determine how efficiently government programs are executed. To learn more about the status of the Army's implementation of the LMP, the author studied GAO reports on the subject.

One GAO report the author studied was released in April 2010 and criticized the Army because its "training strategy did not effectively provide LMP users the skills necessary to perform their new tasks" (p. 2). The report further claimed, "Users at the depots stated that the training they received did not provide a realistic environment that showed them how to perform their expected duties and did not always match their new responsibilities"(p. 2).

Aspects of the LMP influenced by humans, such as training on how to input data, can have a profound impact on data quality because of the risk of human error. If the source data is incorrect or missing, the subsequent data created by the LMP will be flawed and of a low quality. Based on this reality, the author examined documentation and published research on innovative training strategies in order to establish a foundation for this research.

B. BLENDED LEARNING TRAINING

With the development of any new system, whether it's a stealth bomber or an enterprise resource planning (ERP) system, any human interaction with the system requires a training strategy. One innovative strategy is called blended learning. Instead of solely using the traditional brick-and-mortar classroom, blended learning fuses traditional learning with a combination of methods, including digital and web-based instruction. The result is a richness of learning that exceeds what any one method could yield on its own. In fact, students who mix online learning with traditional coursework in a blended learning approach have shown increased learning over students who attend traditional brick-and-mortar schools (Means, Toyama, Murphy, Bakia, Jones, 2010).

As described by Plifka (2011), blended learning has four main areas of instruction: face-to-face (F2F), print, digital, and web. It allows for each area to have subordinate methods of

instruction that can also be blended. These subordinate methods may include distance learning, distributed learning, or traditional learning, just to name a few (see Appendix, Figure 1; Plifka, 2011).

According to Plifka (2011, p. 15), "it is important to know all of these methods of instruction to fully grasp the possible [blended learning] combinations that can be used to create the most effective training program." Plifka continues, "it is also important to take into consideration the objective of the course or program, faculty expertise, student ability, and the infrastructure and available resources of the organization" (2011, p. 15).

The advantages of blended learning include the following:

- enhanced opportunities for teacher-student interaction and increased student engagement in learning through a plurality of mediums;
- greater flexibility and access for students through the incorporation of distance and web-based instruction; and
- greater opportunity to provide students basic information early via web-based instruction in advance of more detailed classroom training. (Plifka, 2011)

In addition to these advantages, blended learning is compatible with the Army's interest in training strategies that are meant to "optimize, synchronize, and support training in schools and in units, and to promote self-development training in order to produce forces capable of responding across the spectrum of operations" (Department of the Army, 2007, page 2).

The LMP training that Army depot employees received was given within the structure of a traditional classroom, and the allotted class time and course format did not allow students to be instructed on basic concepts about the LMP and how it applied to their job. Had the blended learning approach been utilized, many fundamental aspects of the LMP could have been learned via web-based classes during which individual users could have digested elementary material at their own pace as a precursor to more in-depth, hands-on training in either a classroom or venue that approximated the real-world work environment of the user.

C. THE ARMY LEARNING CONCEPT 2015

The concepts contained in the Army Learning Concept 2015 (ALC 2015) is similar to blended learning in that it makes use of multiple training methods, but its focus is on being learner-centric. In other words, ALC 2015 puts the emphasis on adapting the training methodology to the needs and learning strengths of the individual student. This strategic training initiative is described in detail in United States Army Training and Doctrine Command (TRADOC) Pamphlet 525-8-2 (2011), and is a product of the TRADOC, which is a major command of the U.S. Army responsible for overseeing the training of Army forces (TRADOC, n.d.; see Appendix, Figure 2).

ALC 2015 (TRADOC, 2011) was developed in response to the training challenges presented by a population of personnel composed of a diverse mix of ethnic backgrounds, generations, sociological backgrounds, and levels of education. The *ALC 2015* strategy acknowledges that American society is producing a generation of citizenry—from which the Army will draw the soldiers of tomorrow—that will have significant knowledge gaps in reading, writing, mathematics, and other important areas due to failures of the U.S. educational system. Given that the Army must be capable of fielding a force that can defeat any adversary, it is incumbent upon the Army to develop a strategy of quickly and effectively training its personnel in a manner that accommodates the capabilities of the individual learner.

Table 1 contains a succinct comparison between traditional training strategies and those of the *ALC 2015* (TRADOC, 2011).

Table 1. Comparison Between Traditional Training Strategies and *ALC 2015* Strategies

Traditional Training Strategy	***ALC 2015* Strategy**
Instructor-led and structured in a predetermined fashion that is inflexible for meeting individual learner needs	"Possesses an infrastructure that is composed of subject-matter experts and facilitators from the centers of excellence , a digitized learning media production capability, knowledge management structures, and policies and resourcing models that are flexible enough to adapt to shifting operational and learner demands" (TRADOC, 2011)
Based on individual tasks, conditions, and standards, and primarily delivers only concepts and knowledge	Promotes learning " through outcome-oriented instructional strategies that foster thinking, nurture initiative, and provide operationally relevant context" (TRADOC, 2011)
Rigidly formatted programs of instruction (POIs) that do not readily allow for the reflection or repetition needed to process fundamental information	Provides a learner-centric framework that is "continuously accessible and provides learning at the point of need in the learner's career" Learning process begins before initial military training and continues throughout a learner's career via digitized learning content (TRADOC, 2011)
Lecture-based instruction that is oftentimes passive, one-way communication and that does not integrate the accumulated knowledge of learners' past experiences	Provides students with challenging content through a mixture of live teaching and technology in variety of venues Incentivizes individuals to pursue learning that supports position assignments and career goals (TRADOC, 2011)

In short, there are two major goals of the *ALC 2015* (TRADOC, 2011). One is to improve training through "outcome-oriented instructional strategies that foster thinking, nurture initiative, and provide operationally relevant context" (TRADOC, 2011, p.21). The other is to extend this richer learning experience throughout the careers of personnel by making it constantly available via network technologies so that previously learned content is always readily accessible.

The training associated with the LMP was given within a traditional format. Army depot employees would have received an enhanced learning experience if the training had been

administered within the framework of the *ALC 2015* (TRADOC, 2011) approach. Students would not have been subjugated to the one-size-fits-all approach of traditional teaching methods. Instead, the learning environment would have been adapted to a format that would be most beneficial to the specific learning needs of individual personnel. Additionally, as time moves on, personnel would continue to have had ready access to previously learned material on an as-needed basis throughout the balance of their careers.

D. LOGISTICS MODERNIZATION PROGRAM BACKGROUND

In order to properly couch the prior discussion on training strategies within the context of the LMP, it is beneficial to discuss how and why the LMP was developed. Prior to the LMP, for about 30 years the Army had used the Commodity Command Standard System (CCSS) and the Standard Depot System (SDS) to support the Army's procurement of supplies and equipment. These systems were managed by the Communications-Electronics Command (CECOM; Hill, 2007, p. 47). Though useful, these systems were not as capable as state-of-the-art logistical planning systems being developed and implemented in private industry.

In 1997, two important documents were created that would set the DoD on a path toward the eventual creation of the LMP. The first document was the *Quadrennial Defense Review* (Office of the Secretary of Defense [OSD], 1997a). In the *Quadrennial Defense Review* a military asset management plan was described that emphasized "focused Logistics" (OSD, 1997a, p. 4). This plan articulated DoD intentions to take advantage of information technology breakthroughs in the civilian sector and apply those technologies within the DoD to radically improve supply chain management. The second document was the 1997 *Defense Reform Initiative* (*DRI*), chartered by Secretary of Defense William Cohen. Its purpose was to study changes that the DoD needed to make to its business processes in order to become more efficient. The initiative also "authorized the services and DOD support agencies to begin IT projects to acquire systems that will help the Department perform 'just-in-time' logistics" (Hill, 2007, p. 47).

That same year, in response to the *DRI*, a CECOM project team was charged with assessing SDS and CCSS. Hill provides the following list of conclusions about the team's assessment of the weaknesses of SDS and CCSS:

- *Lack of flexibility:* Process changes, regulatory changes, and reorganizations within and between user commands require expensive and extensive data conversions and programming changes.
- *Slow, unfocused reports:* Reporting and summarization capabilities are geared to workers. Managers and executives, with their need for easily specified, flexible, tailored, and rapid generation of reports and summaries are usually frustrated with output capabilities.
- *Difficult to use:* The system is not user friendly. The system relies on extensive use of codes to provide compact storage (a holdover from the time when computer storage was inordinately expensive). Users are required to learn codes and have extensive system knowledge. The system lacks adequate data edits and validations, as well as support functions.
- *Expensive to maintain:* The system's size and complexities make it difficult to manage and change code. Large portions are based on relatively old third-generation programming languages and flat data structures that are inflexible to change and inefficient to operate.
- *Unresponsive:* The use of batch processing precludes timely updates to data architecture, flexible data retrieval capabilities, and informed decision-making.
- *Outmoded database:* The use of outmoded database systems and architecture result in rampant data inconsistencies, data duplication, and the lack of data standardization.
- *Expensive to operate:* The system requires extensive manual intervention because of outmoded data and system architectures.
- *Lack of cost-sharing:* The Army is the only "bill payer," precluding the ability to leverage existing industry investments in modern logistics processes and IT. (Hill, 2007, p. 47)

The CECOM project team also recommended that the AMC outsource the development of a replacement system based on specific performance requirements that would address the shortcomings of SDS and CCSS. Because the development was inherently an outsourcing activity, the Office of the Secretary of Defense (OSD) directed the project team to follow Office of Management and Budget (OMB) Circular A-76 guidelines. After a period of deliberation between the offices of the primary stakeholders (which included the National Federation of Federal Employees [NFFE] and the AMC Commanding General), the Secretary of the Army finally granted the AMC the authorization to move forward on the outsourcing procurement. On December 30, 1999, the Computer Sciences Corporation (CSC) was awarded a contract to develop a system for replacing SDS and CCSS. That system came to be known as the Logistics Modernization Program (Hill, 2007, p. 48).

Upon contract award, CSC immediately went to work on the LMP, and by November 2002 end user training and testing was underway, with the testing designed to determine if the LMP met the requirements established for it by the AMC (Caterinicchia, 2002). Having passed the initial testing, the first LMP deployment occurred in February 2003. In October 2010 the final LMP deployment was fielded to the JMC. However, a variety of factors have prevented the JMC from fully benefiting from the LMP's promised functionality, not the least of which has been the fight to achieve and maintain data quality.

E. DATA QUALITY DESCRIPTION

In order to understand data quality, it must first be established that its nature is both multidimensional and hierarchical. These characteristics are most evident when one considers that first and foremost, the data must be accessible. Second, the data must be interpretable. Third, the data must be useful. Finally, the data must be believable. These basic requirements form the primary dimensions of data quality (Wang, Reddy, & Kon, 1992).

When considering the accessible dimension, at least one prerequisite is the need for the data to be available. Likewise, in order to have useful data, it must first be relevant. The relationships among these dimensions and sub-dimensions are depicted (see Appendix, Figure 3, Wang et al., 1992).

The multidimensional and hierarchical nature of data quality provides a conceptual framework for understanding the characteristics that define data quality. In this research project completeness and accuracy are the relevant dimensions for assessing the quality of data obtained by the JMC Enterprise Integration Data Team. Component organizations of the JMC generate the data quality scores as one measure of how well they are executing their missions.

F. MISSIONS OF THE JMC COMPONENT ORGANIZATIONS

The value of the data being utilized within the JMC is tied to the missions performed by the component organizations. Therefore, any discussion about the quality of data would be incomplete without at least a brief overview of those missions. The following sections summarize the missions of JMC component organizations whose BOM data was used in this research.

1. Blue Grass Army Depot

Located in Richmond, Kentucky, Blue Grass Army Depot (BGAD) is a "Strategic Mobility Power Projection ammunition depot and the primary Southeast Regional Distribution Point for all Department of Defense (DOD) munitions" (BGAD, n.d.) Sitting on over 14,000 acres and possessing a storage capacity of over 3 million square feet, it supports the DoD through the receipt, storage, maintenance, shipping, and demilitarization of a vast variety of standard and non-standard ammunition (BGAD, n.d.).

2. Letterkenny Munitions Center

Letterkenny Munitions Center is a tenant of Letterkenny Army Depot and located in Chambersburg, Pennsylvania. Occupying about 16,000 acres, it's a Strategic Mobility Platform, specializing in the receipt, storage, and maintenance of a variety of Army, Air Force, and Navy missiles systems. These systems include the Sidewinder, Sparrow, High-speed Anti-radiation Missile (HARM), Joint Air-to-Surface Stand-off Missile (JASSM), and the Advanced Medium Range Air-to-Air Missile (AMRAAM; Crane Army Ammunition Activity, n.d.-b).

3. McAlester Army Ammunition Plant

Located in McAlester, Oklahoma, McAlester Army Ammunition Plant (MCAAP) is the DoD’s premier facility for loading bombs with energetics such as TNT. Covering 44,964 acres and with a storage capacity of over 8.8 million square feet, it shares many of the capabilities of BGAD in that it receives stores, maintains, ships and demilitarizes a huge variety of munitions (MCAAP, n.d.).

4. Tooele Army Depot

Tooele Army Depot is located in Tooele, Utah. Occupying 23,610 acres and possessing more than 2.4 million square feet of storage space, its mission is similar to that of BGAD and MCAAP in that it receives, stores, maintains, ships, and demilitarizes munitions. But unlike the other components it also designs, manufactures, and supports the special equipment needed to perform ammunition maintenance and demilitarization activities (Tooele Army Depot, n.d.).

5. Crane Army Ammunition Activity

As a tenant of the Navy Region Midwest, Naval Support Activity, Crane Army Ammunition Activity is located in Crane, Indiana. It occupies more than 51,000 acres and can store 650,000 tons of ammunition related stock. Like BGAD and MCAAP, its primary mission is to receive, store, ship, produce, renovate, and demilitarize conventional ammunition (Crane Army Ammunition Activity, n.d.-a).

6. Pine Bluff Arsenal

Located in Pine Bluff, Arkansas, Pine Bluff Arsenal’s primary mission is the production of smoke, incendiary, and pyrotechnic munitions and devices. It also tests chemical defense clothing (Bearden, 2012).

G. BILLS OF MATERIAL DATA QUALITY AUDIT PROCESS DESCRIPTION

As the aforementioned components of the JMC execute their assigned missions, they have the responsibility of achieving and maintaining data quality goals, as well as performing data quality audits. However, the management of the overall data quality program belongs to the JMC Enterprise Integration Data Team.

Before an audit begins, the JMC Enterprise Integration Data Team notifies the BOM business process owner (BPO) of each component organization and sends a standardized JMC data accuracy scorecard with which to conduct the audit. Currently, the scorecard is a customized spreadsheet.

During the first phase of the audit, the BPOs check each of the LMP BOM records according to the completeness and accuracy of 13 data elements. These elements consist of BOM usage, base quantity, valid-from date, item category, BOM component, component quantity, component unit of measure, explosive type, inductive recursiveness allowed, inductive relevancy to costing, issue location, component supply area, and special process type. During the audit, records found with at least one incorrect element are designated “fail.” Alternatively, if all elements of a record are determined to be correct, the record receives a “pass.”

As the first phase is being completed, the scorecard automatically populates a data summary that displays critical metrics such as audit date, total BOMs audited, total BOMs passed, total BOMs failed, percent accuracy, percent accuracy target, defect quantities by critical data element, total defects, and defects per defective record.

During the second phase, the BPO and subordinate personnel identify the root causes of the failures as well as corrective actions that should prevent failure reoccurrence. Both failures and corrective actions are then recorded directly into the scorecard.

Once the audit is complete, the BOM records and audit findings are submitted to the JMC Enterprise Integration Data Team for validation. After the results are validated, the scorecards are posted on the JMC Enterprise Integration Data Team’s SharePoint site and retained by the team to use on subsequent audits (R. Fuller, personal communication, June 19, 2012).

H. SUMMARY

In this chapter the author began with a literature review that included a discussion on innovative training strategies. That discussion stemmed from a 2010 GAO report that was critical of how the Army trained its personnel for using the LMP. Afterwards, the author discussed the development of the LMP, the nature of data quality, and the missions of JMC component organizations. The author wrapped up the chapter with an overview of the data audit process. In Chapter III, the author displays BOM defect data from six major components of the JMC.

III. BOM DEFECT DATA SUMMARY

In order to respect confidentiality, direct references to specific organizations have been changed to the generalized names of Component A, Component B, and so forth. The defect data in Tables 2–7 originated from scorecards published by the JMC Enterprise Integration Data Team (R. Fuller, personal communication, June 19, 2012). Tables 8–13 and Figures 4–10 were created using data from the same scorecards. The author added the qualification data in the table columns labeled “category.” The qualification data was also used in the figures. For the sake of authenticity, error and root cause descriptions were taken verbatim from the scorecards.

A. SCORECARD DEFECT DATA

Table 2. Defect Data for Component A (From: R. Fuller, personal communication, June 19, 2012)

DATA OBJECT ACCURACY SUMMARY							DEFECT QUANTITIES BY CRITICAL DATA ELEMENT														
							1	2	3	4	5	6	7	8	9	10	11	12	13		
Audit Date	BOMs Audited	Total BOMs Passed	Total BOMs Failed	% Accuracy	Target % Accuracy		BOM usage	base quantity	valid from-date	item category	BOM component	component quantity	component unit of measure	explosive type	inductive recursiveness allowed	inductive relevancy to costing	issue location	component supply area	special process type	**Total Defects**	Defects per Defective Record
9/7/2011	370	73	297	**19.7%**	**98.0%**		46	0	0	45	0	0	0	141	1	9	101	899	3	**1,245**	4.2

Note. The data in this table was taken from scorecards the author was given access to on the JMC Data Quality Team's SharePoint website (R. Fuller, personal communication, June 19, 2012).

Table 3. Defect Data for Component B (From: R. Fuller, personal communication, June 19, 2012)

DATA OBJECT ACCURACY SUMMARY							DEFECT QUANTITIES BY CRITICAL DATA ELEMENT														
							1	2	3	4	5	6	7	8	9	10	11	12	13		
Audit Date	BOMs Audited	Total BOMs Passed	Total BOMs Failed	% Accuracy	Target % Accuracy		BOM usage	base quantity	valid from-date	item category	BOM component	component quantity	component unit of measure	explosive type	inductive recursiveness allowed	inductive relevancy to costing	issue location	component supply area	special process type	**Total Defects**	Defects per Defective Record
2/2/2012	133	99	34	**74.4%**	**98.0%**		13	0	0	0	4	0	0	17	0	59	30	0	14	**137**	4
9/26/2011	155	58	97	**37.4%**	**98.0%**		165	0	0	0	0	0	0	39	21	21	16	190	0	**452**	4.7

Note. The data in this table was taken from scorecards the author was given access to on the JMC Data Quality Team's SharePoint website (R. Fuller, personal communication, June 19, 2012).

Table 4. Defect Data for Component C (From: R. Fuller, personal communication, June 19, 2012)

DATA OBJECT ACCURACY SUMMARY						**DEFECT QUANTITIES BY CRITICAL DATA ELEMENT**														
						1	2	3	4	5	6	7	8	9	10	11	12	13		
Audit Date	BOMs Audited	Total BOMs Passed	Total BOMs Failed	% Accuracy	Target % Accuracy	BOM usage	base quantity	valid from-date	item category	BOM component	component quantity	component unit of measure	explosive type	inductive recursiveness allowed	inductive relevancy to costing	issue location	component supply area	special process type	**Total Defects**	Defects per Defective Record
3/29/2012	247	246	1	**99.6%**	**98.0%**	0	0	0	0	0	0	0	0	0	3	0	0	0	**3**	3
2/2/2012	210	194	16	**92.4%**	**98.0%**	0	0	0	0	0	0	0	7	0	49	7	21	0	**84**	5.3
9/27/2011	199	177	22	**88.9%**	**98.0%**	0	0	0	0	0	0	0	27	3	31	16	40	0	**117**	5.3
9/13/2011	199	199	0	**100%**	**98.0%**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note. The data in this table was taken from scorecards the author was given access to on the JMC Data Quality Team's SharePoint website (R. Fuller, personal communication, June 19, 2012).

Table 5. Defect Data for Component D (From: R. Fuller, personal communication, June 19, 2012)

DATA OBJECT ACCURACY SUMMARY						DEFECT QUANTITIES BY CRITICAL DATA ELEMENT														
						1	2	3	4	5	6	7	8	9	10	11	12	13		
Audit Date	BOMs Audited	Total BOMs Passed	Total BOMs Failed	% Accuracy	Target % Accuracy	BOM usage	base quantity	valid from-date	item category	BOM component	component quantity	component unit of measure	explosive type	inductive recursiveness allowed	inductive relevancy to costing	issue location	component supply area	special process type	**Total Defects**	Defects per Defective Record
5/24/2012	135	131	4	**97.0%**	**98.0%**	0	0	0	0	0	0	0	0	0	0	4	0	0	**4**	1.0
1/11/2012	131	130	4	**99.2%**	**98.0%**	0	0	0	0	0	1	0	0	0	0	0	0	0	**1**	1.0
9/13/2011	195	183	12	**93.8%**	**98.0%**	0	0	0	0	0	0	3	1	0	4	0	16	0	**24**	2.0

Note. The data in this table was taken from scorecards the author was given access to on the JMC Data Quality Team's SharePoint website (R. Fuller, personal communication, June 19, 2012).

Table 6. Defect Data for Component E (From: R. Fuller, personal communication, June 19, 2012)

DATA OBJECT ACCURACY SUMMARY							DEFECT QUANTITIES BY CRITICAL DATA ELEMENT														
							1	2	3	4	5	6	7	8	9	10	11	12	13		
Audit Date	BOMs Audited	Total BOMs Passed	Total BOMs Failed	% Accuracy	Target % Accuracy		BOM usage	base quantity	valid from-date	item category	BOM component	component quantity	component unit of measure	explosive type	inductive recursiveness allowed	inductive relevancy to costing	issue location	component supply area	special process type	**Total Defects**	Defects per Defective Record
10/24/2011	85	58	27	**68.2%**	**98.0%**		1	1	1	1	40	27	1	1	1	1	4	1	1	**81**	3

Note. The data in this table was taken from scorecards the author was given access to on the JMC Data Quality Team's SharePoint website (R. Fuller, personal communication, June 19, 2012).

Table 7. Defect Data for Component F (From: R. Fuller, personal communication, June 19, 2012)

DATA OBJECT ACCURACY SUMMARY							DEFECT QUANTITIES BY CRITICAL DATA ELEMENT														
							1	2	3	4	5	6	7	8	9	10	11	12	13		
Audit Date	BOMs Audited	Total BOMs Passed	Total BOMs Failed	% Accuracy	Target % Accuracy		BOM usage	base quantity	valid from-date	item category	BOM component	component quantity	component unit of measure	explosive type	inductive recursiveness allowed	inductive relevancy to costing	issue location	component supply area	special process type	**Total Defects**	Defects per Defective Record
11/22/2011	123	123	4	**100.0%**	**98.0%**		0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0.0
11/4/2011	741	740	4	**99.9%**	**98.0%**		0	0	0	0	2	0	0	0	0	0	0	0	0	**2**	2.0
9/30/2011	741	168	573	**22.7%**	**98.0%**		0	2	0	90	2	5	0	200	0	0	249	0	1,577	**2,125**	3.7

Note. The data in this table was taken from scorecards the author was given access to on the JMC Data Quality Team's SharePoint website (R. Fuller, personal communication, June 19, 2012).

B. DEFECT DATA QUALIFIED BY CATEGORY

Table 8. Defect Qualification Data for Component A (After: R. Fuller, personal communication, June 19, 2012)

Audit Date	Data Element	Error Description	Root Cause	Category	Qty
9/7/2011	BOM Usage	BOM Usage cCode "R"	Change in BOM business rules after originally built	Policy	46
9/7/2011	Item Category	Code "Y"	Personnel was not fully educated at time of creation of BOMs. JM&L BOM process has changed since go-live. Should have been "L" or "N"	Training	45
9/7/2011	Explosive Type	Blank or incorrect type	Change in business rules and not understanding how each tyoe worked with Planning MRP/Inventory	Training	141
9/7/2011	Ind-Recursiveness-Allowed	Entered wrong data	Did not properly mark Demil component for recursiveness	Training	1
9/7/2011	Ind-Relevancy-to-Costing	Entered incorrect data or left blank	No standard business rule for relevancy costing at time of creation	Policy	9
9/7/2011	Issue-Location	Storage Location Left Blank	Personnel did not enter storage location	Training	101
9/7/2011	Component-Supply-Area	Left Blank	Personnel did not enter Supply Area	Training	899
9/7/2011	Special-Proc-Type	Incorrect data	Lack of knowledge when creating BOM	Training	3

Note. The data in the first four columns of this table was taken from scorecards the author was given access to on the JMC Data Quality Team's SharePoint website (R. Fuller, personal communication June 19, 2012).

Table 9. Defect Qualification Data for Component B (After: R. Fuller, personal communication, June 19, 2012)

Audit Date	Data Element	Error Description	Root Cause	Category	Qty
9/26/2011	Component-Supply-Area	Supply Area Blank or incorrect	Inadequate guidance, was not initially required to be populated	Training	190
9/26/2011	BOM-Usage	Actually Incorrect BOM Status	Inactive BOMs that were marked as active, human error	Training	165
9/26/2011	Explosion-Type	Left Blank	Operator error, not marked when making the BOM	Training	39
9/26/2011	Ind-Recursiveness-Allowed	(5) Incorrectly flagged as Recursive-Allowed	Initial setup not changed, guidance	Training	5
9/26/2011	Ind-Recursiveness-Allowed	(16) Flagged as recursive, if not causes error in production results	Business process changed, recursive required for correct production results, does not fit with business rules	Policy	16
9/26/2011	Ind-Relevancy-to-Costing	Incorrectly flagged for Costing	Setup according to initial guidance not updated, business process changed not updated during change	Policy	21
9/26/2011	Issue-Location	Left Blank	Changed business process, not updated during change	Policy	16
2/2/2012	Component Supply Area	Supply Area Blank or incorrect on BOMs	Guidance received included placing PSA on work centers, this does not show on the BOM audits, per JM&L guidance not to be counted as a BOM audit error	Policy	8
2/2/2012	Ind-Relevancy-to-Costing	Incorrectly identified for Costing	Based on MRP running and changes resulting from eliminating recursiveness, not all BOM components had been updated	Process	59
2/2/2012	Issue-Location	Incorrect value or left blank	WH location not reviewed and added or updated while preparing for MRP	Training	30
2/2/2012	Explosion-Type	Left Blank	Operator error, not marked when making the BOM	Training	17
2/2/2012	Special Procument Type	Incorrect value or left blank	As a result of recursive changes and MRP being run, BOMs were revised, not all corrections made	Process	14
2/2/2012	BOM-Usage	Actually Incorrect BOM Status	As a result of recursive changes and MRP being run, BOMs were not revised to be inactive, human error	Process	13
2/2/2012	BOM-Component	Components not deleted from BOM	As a result of recursive changes and MRP being run, BOMs were changed and components were not deleted from the BOM, human error	Process	4

Note: The data in the first four columns of this table was taken from scorecards the author was given access to on the JMC Data Quality Team's SharePoint website (R. Fuller, personal communication June 19, 2012).

Table 10. Defect Qualification Data for Component C (After: R. Fuller, personal communication, June 19, 2012)

Audit Date	Data Element	Error Description	Root Cause	Category	Qty
9/27/2011	Component supply area	should be blank for all negative quantities	error due to new/updated JM&L business rules	Policy	40
9/27/2011	relevancy to costing	Not cost relevant for negetive quantities	error due to new/updated JM&L business rules	Policy	31
9/27/2011	explosion type	should be marked as R2	error due to new/updated JM&L business rules	Policy	27
9/27/2011	issue location	blanks not allowed	error due to new/updated JM&L business rules	Policy	16
9/27/2011	recursiveness allowed	recursiveness not allowed for negetive quantities	error due to new/updated JM&L business rules	Policy	3
2/2/2012	explosion type	should be marked as R2 for non-text components	human error	Training	7
2/2/2012	relevancy to costing	Not cost relevant for negetive quantities	human error	Training	49
2/2/2012	issue location	blanks not allowed for non-text components	human error	Training	7
2/2/2012	supply area	should be blank for all negetive quantities	human error	Training	21
3/29/2012	relevancy to costing	Not cost relevant for negetive quantities	human error	Training	3

Note: The data in the first four columns of this table was taken from scorecards the author was given access to on the JMC Data Quality Team's SharePoint website (R. Fuller, personal communication June 19, 2012).

Table 11. Defect Qualification Data for Component D (After: R. Fuller, personal communication, June 19, 2012)

Audit Date	Data Element	Error Description	Root Cause	Category	Qty
9/13/2011	Component Supply Area	Incorrect supply area	Definition was changed during the audit; Data was correct at time of audit but not at time of data pull	Policy	16
9/13/2011	Costing	Does not show costing relevancy	Human error; planner entered incorrect data when building BOM	Training	4
9/13/2011	Unit of Measure	Material master error	Cataloging error in legacy data	Process	3
9/13/2011	Explosive Type	Incorrect explosive type	Explanation of difference between R1 and R2 was unclear, resulting in error when building BOM	Training	1
1/11/2012	Component - Quantity	Value listed as a positive number instead of negative number	Making corrections to the unit of measure in the baseline audit caused the change in the component quantity critical element	Training	1

Note: The data in the first four columns of this table was taken from scorecards the author was given access to on the JMC Data Quality Team's SharePoint website (R. Fuller, personal communication June 19, 2012).

Table 12. Defect Qualification Data for Component E (After: R. Fuller, personal communication, June 19, 2012)

Audit Date	Data Element	Error Description	Root Cause	Category	Qty
10/24/2011	BOM Component	Components were deleted or added	BOM changes were not communicated to the LMP workers	Process	40
10/24/2011	Component Qty	Qty of tape was fine-tuned or usage factors were inserted into RBOMs (TACOM workload)	Paying closer attention to processes but not communicating to the LMP workers	Training	27
10/24/2011	Issue Location	Blank when should not have been	Requirement to have this set, not widely communicated	Process	1
10/24/2011	BOM Usage	Component was deleted so SME marked all fields	Ambiguous issue, should all be marked F if component is deleted or added; regular DQ lead gone for 1 wk and fill-in not familiar with audits (many hats, less heads)	Training	1
10/24/2011	Base Qty	Component was deleted so SME marked all fields		Training	1
10/24/2011	Valid from Date	Component was deleted so SME marked all fields		Training	1
10/24/2011	Item Category	Component was deleted so SME marked all fields		Training	1
10/24/2011	C-UOM	Component was deleted so SME marked all fields		Training	1
10/24/2011	Explosion Type	Component was deleted so SME marked all fields		Training	1

Note: The data in the first four columns of this table was taken from scorecards the author was given access to on the JMC Data Quality Team's SharePoint website (R. Fuller, personal communication June 19, 2012).

Table 13. Defect Qualification Data for Component F (After: R. Fuller, personal communication, June 19, 2012)

Audit Date	Data Element	Error Description	Root Cause	Category	Qty
9/30/2011	Base Quantity	Initial input was for total number of parts generated from a bar of aluminum for a grenade tops and bottoms project	Input was from Oct 1, 2009; initial learning phase	Training	2
9/30/2011	Item Category	N entered; Should be L	N Non-Stock L Stock Incorrect input. Confusion on what should be entered. All errors are basically from 2 BOM's and 2 dates. This error was noted prior to audit because of issues related to MRP.	Training	90
9/30/2011	BOM Component	Wrong Part Number entered	Typographical error	Process	2
9/30/2011	ExplosionType	Missing ExplosiveType. Should read R2	Majority of errors from 5 Bombs and 5 dates; lack of user knowledge	Training	200
9/30/2011	Issue Storage Location	Missing Issue Location. Should read WH01 or WH05	Majority of errors were conducted on 5 dates; lack of user knowledge	Training	249
9/30/2011	Supply Area	Missing Component Supply Area. For example should read 059400-05B or 059400-01B	This seems to be a systemic problem. This was a late requirement that was handed down in late August/September 2010. Many BOMs were built prior to guidance and have not been changed. Also issue with user knowledge.	Policy	1577
9/30/2011	Component Quantity	Incorrect Quantity for what is required	Typographical error	Process	5
11/4/2011	BOM Component		Pending Material Master typographical error confirmation. Possible data pull anomaly. Actual BOM reflects correct material numbers.	Process	2

Note: The data in the first four columns of this table was taken from scorecards the author was given access to on the JMC Data Quality Team's SharePoint website (R. Fuller, personal communication June 19, 2012).

C. DEFECT TRENDS DATA

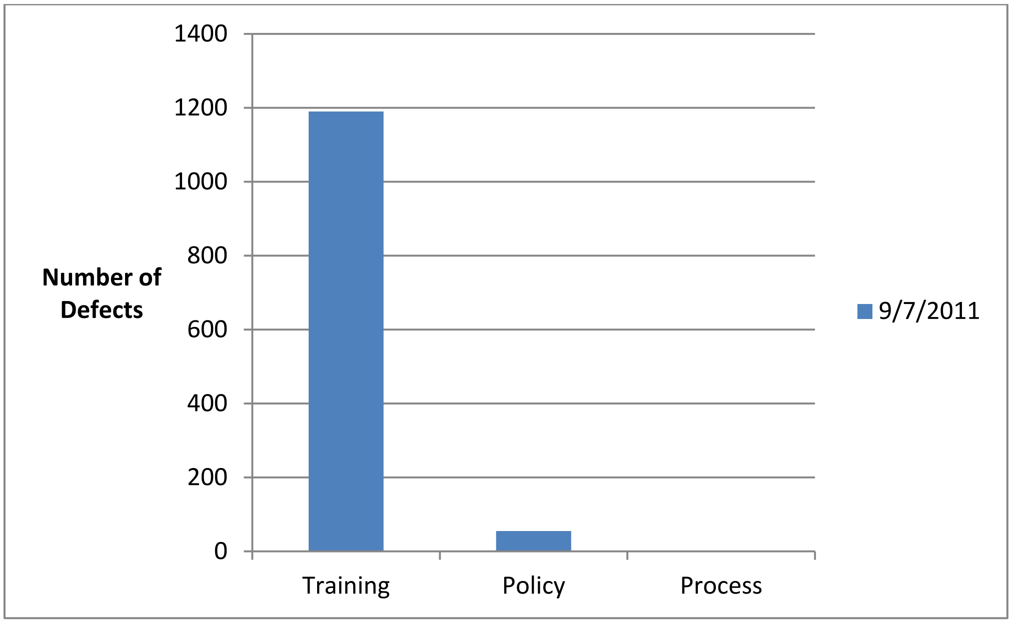

Figure 1. Component A Defects by Category

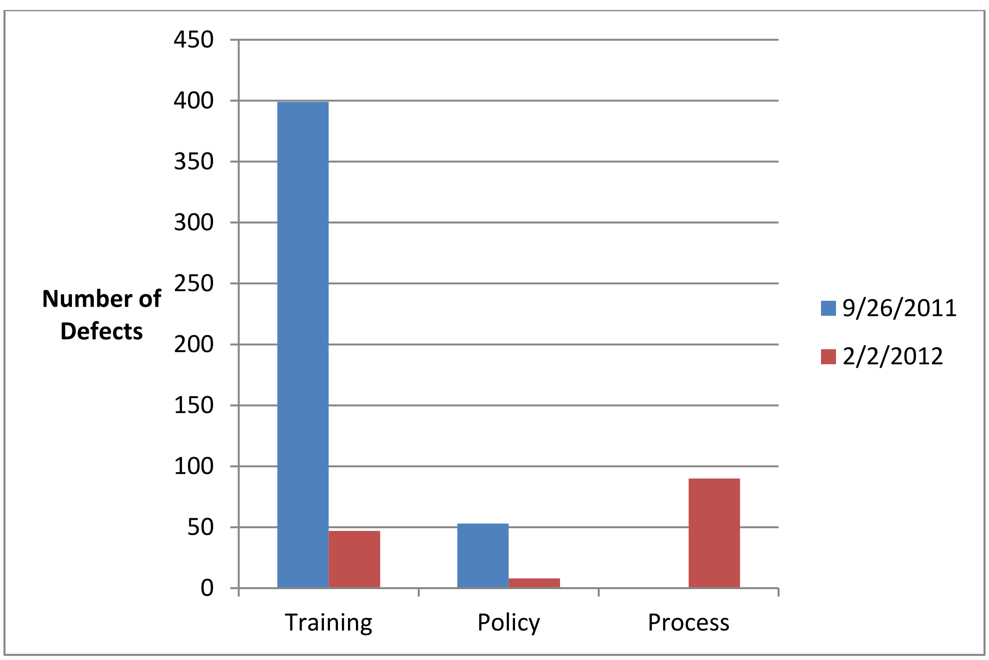

Figure 2. Component B Defects by Category

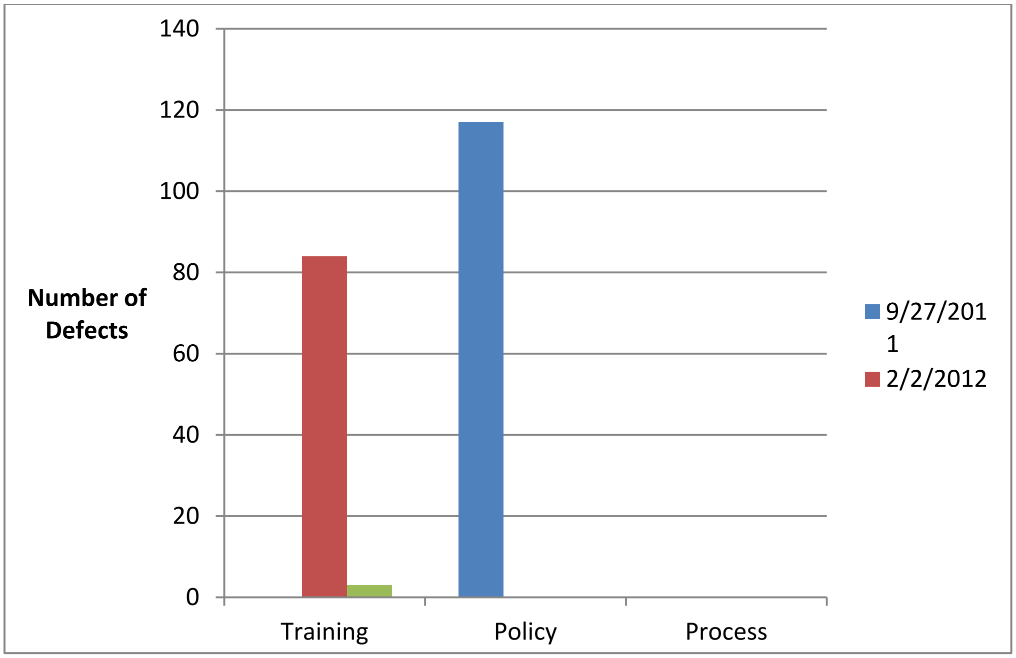

Figure 3. Component C Defects by Category

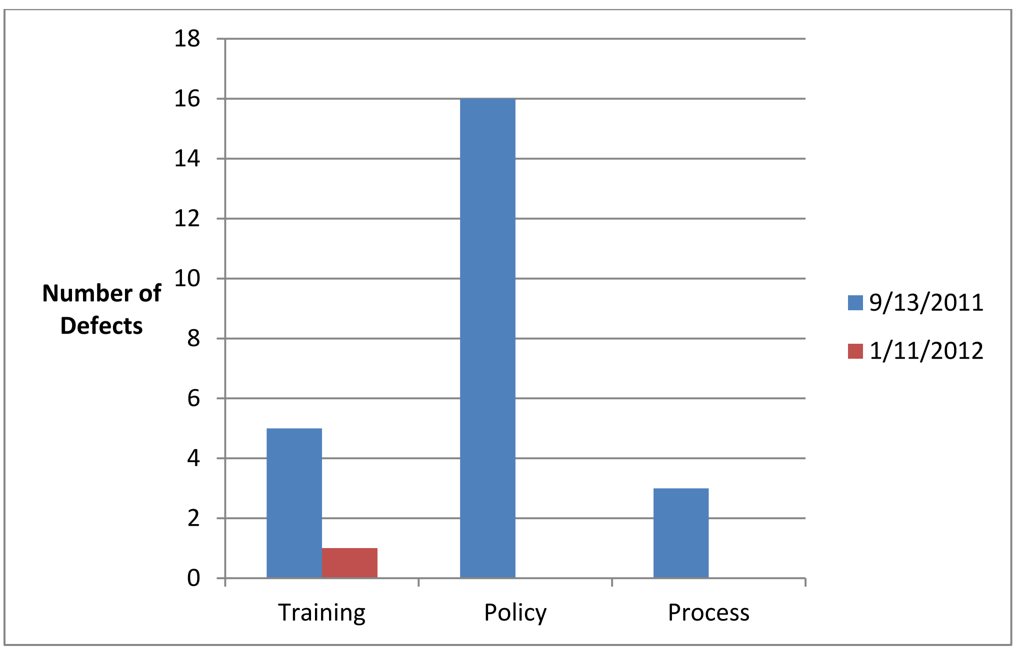

Figure 4. Component D Defects by Category

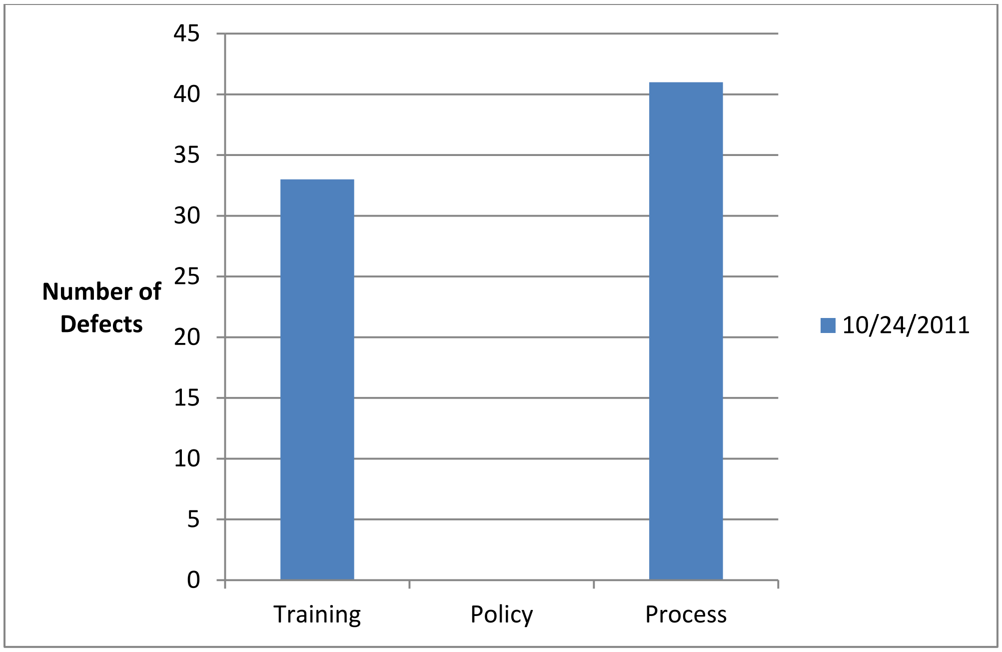

Figure 5. Component E Defects by Category

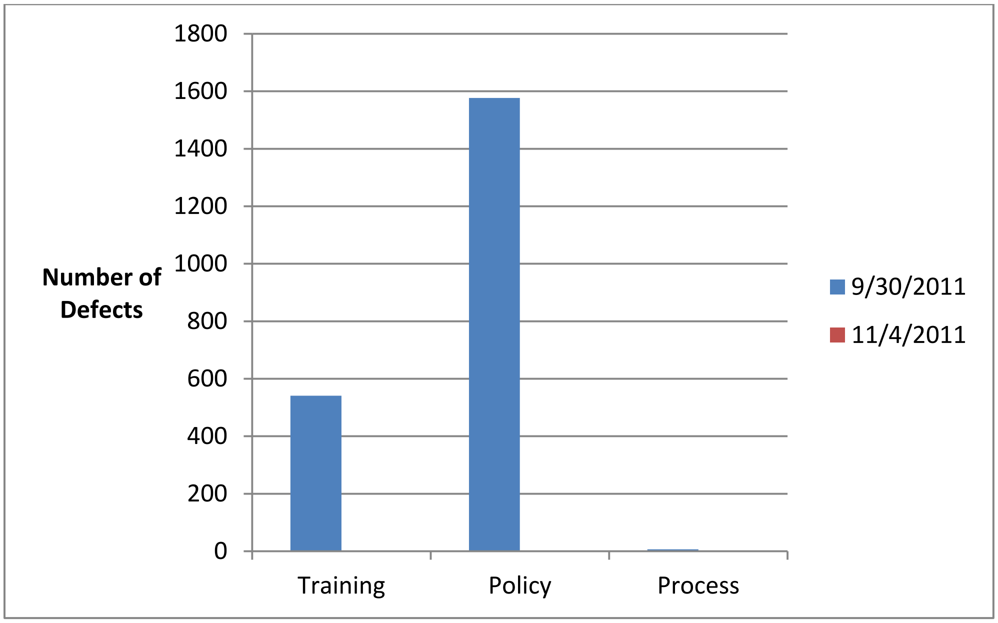

Figure 6. Component F Defects by Category

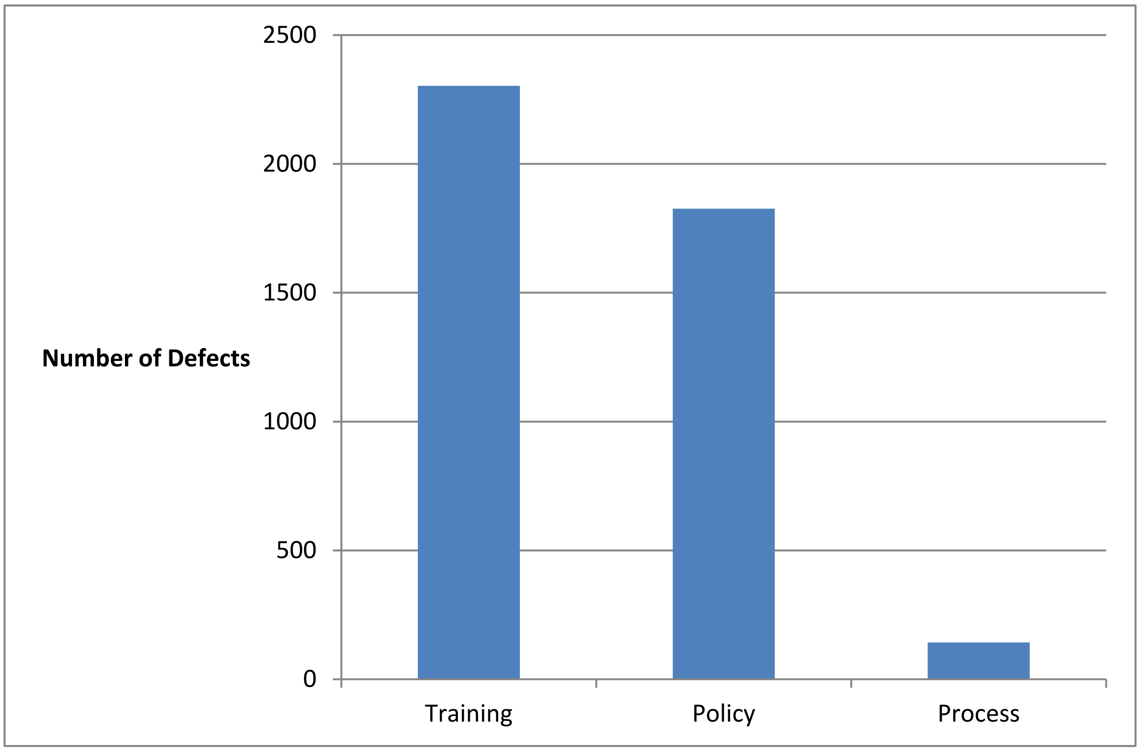

Figure 7. Overall Defects by Category

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IV. ANALYSIS

A. DATA QUALIFICATION

The data in Tables 2–7 comes directly from scorecards generated by the component organizations of the JMC. The benefit of these tables is that they allow the reader to see the types and number of defects for each audit that was conducted. For example, in Table 3 the data shows that on September 26, 2011, Component B conducted an audit of 155 BOMs. Within those BOMs, a total of 452 defects were found. Of those defects, none were with the special process data element; however, there were 190 defects associated with the component supply data element. At the next audit on February 2, 2012, 133 BOMs were audited and a total of 137 defects were found. Of those defects, 14 were special process type defects and there were no component supply defects.

Based on these observations, it is evident that although the total number of defects dropped at the second audit, the reduction did not extend consistently to all the data elements. For example, the special process type defects actually increased by 14, while the component supply defects dropped from 190 to 0. It is clear that some degree of defect qualification is needed to obtain anything meaningful from this data.

Tables 8–13 incorporate BPO input in the error description and root cause columns that introduce the first level of qualification. The information is particularly useful in that it provides tactical-level reasons why defects occurred. For example, the data in Table 3 shows that there were 39 explosive-type defects from the September 26 audit of Component B, but in the error description and root cause columns of Table 9, the data indicates that those defects were due to blank data fields that were not marked as the BOM was being created.

Possessing the degree of detail shown in Tables 8-13 is helpful in identifying defect causes. However, the specificity of the defect causes hindered the author from performing a meaningful analysis. The author also reasoned that the development of a strategy for eventually reducing defects would require a higher level of qualification. It

was therefore necessary to further qualify the data by grouping the root causes into descriptive categories. In surveying the root causes, the author observed that they could be grouped into three categories: training, process, and policy. For example, the aforementioned 39 explosive-type defects that had unmarked data fields were categorized as *training* because JMC personnel presumably did not know the required documentation procedure and lacked adequate training. In another instance on Table 9, the 13 BOM usage defects were categorized as *process* because the root cause information showed that the defects could have been prevented had the BPO implemented a procedure requiring the removal of obsolete components whenever the MRP was implemented. In still another example, 21 inductive relevancy to costing defects were categorized as *policy* because the root cause description indicated a level of uncertainty regarding the application of business rules. Although this categorization method is not an exact science, the author believes that enough information is present in the data to adequately delineate between the categories without introducing significant amounts of subjectivity.

B. DATA TRENDS

With the data qualified into three different categories, seeing the trends and patterns is a much more obvious exercise. Figures 4–9 show the qualified defects by quantity and the audit dates for each of the six components of the JMC, and Figure 10 gives a similar but more cumulative look at data defects.

1. Training

As was no surprise, inadequate training was the greatest overall source of data defects, as seen in Figure 10. The 2010 GAO report referenced in Chapter II linked training with data quality. However, it was interesting to notice how quickly the training defects decreased with subsequent audits. The only exception to this trend of decreasing defects was observed in Figure 6 with Component C. This indicates that significant learning may be happening through the auditing process rather than through the training processes. While it is certainly commendable to learn from the audits, the audit process is designed to gain status and not provide training. Because of this, the declining trend in training-related data defects may not be an indicator that the actual training has improved.

2. Policy

Policy-related defects were surprisingly the second highest source of data defects, not far behind training-related defects. In Components C, D, and F, policy was actually the leading cause of defects. Like training, policy-related defects tended to decrease with subsequent audits. This is indicative of component organizations that initially had shifting, non-existent, or amorphous policies concerning the management of BOM data within the LMP. At some later point, perhaps in part due to audits, these organizations developed workable policies. This point is especially clear in Table 13, which shows that 1,577 policy defects were attributed to a policy change that apparently occurred after the BOMs were already built.

3. Process

The author anticipated that process-related issues were a significant source of defects. In Component E, process defects were in fact the largest source of data defects. However, in all the other components defects directly related to process issues were virtually non-factors. Considering that the sample size for Component E was relatively small, the high number of process defects observed could easily have been an outlier.

Although the author did not observe a direct connection between process and data defects, the analysis does indicate an indirect relationship by way of training and policy issues. Study of the training and policy defect data indicates that improving the internal processes inherent to training and policy development can present opportunities to reduce data defects. For example, in Table 13 the 541 training defects of Component F could possibly have been avoided if Component F had implemented a process for assessing and addressing the knowledge gaps of each user providing inputs to BOM data. A similar point can be made regarding the need for a process that synthesizes the best data management policies. Additionally, there is a need for a better process of updating and communicating policy changes as conditions warrant.

C. APPLICATION WITHIN THE LMP

Up to this point, the discussion has centered primarily around data quality within the LMP. By focusing on such a narrow topic, the bigger picture of data quality's significance within the LMP should be clarified. The life blood of any AIS is the information within it. No matter how impressive the processing power, memory, bandwidth, or any other system specification, the system as a whole is of little value without data. To take this point a step further, even if a highly capable AIS has data, the system is still of little value unless the data is of good quality—meaning that it is accurate, accessible, believable, useful, and so forth. As the Army's latest major AIS, the LMP is utilized by the JMC to manage over $30 billion in weaponry, as well as the supporting structure of multiple thousands of people and facilities spread across several states—a mission that is desperately dependent upon quality data.

An example will help to illustrate the link between data quality and a typical JMC operation. The 105mm round is a popular munition used by the Army, Air Force, and Marines. The MCAAP is one of a few components of the JMC that stores tens of thousands of 105mm rounds. In this example, the JMC provided funds to the MCAAP to renovate a special variant of the 105mm round that was urgently needed to support operations in Afghanistan. A crucial part of the renovation process is replacing non-serviceable 105mm round components. These components are listed on a 105mm round BOM. One of those components that typically needs replacement is the fuze. In this example, an ammunition planner—who is also an LMP user—mistakenly overwrites the unit of measure element for the fuze on the BOM as pallets whereas it should be as each. In doing so, the ammunition planner unknowingly created defective data. This defective BOM data was passed along to other LMP users, such as to the procurement personnel who order supplies. In this case, due to the defective unit of measure used for the fuze, the procurement personnel failed to order enough fuzes to service all the rounds the MCAAP was funded to perform. The immediate consequence was that the 105mm renovation line came to a halt once the fuzes run out and did not restart until more fuzes were ordered, produced, shipped, delivered, and received—a process that takes about a month. In turn, this resulted in either the Afghanistan mission being delayed by a month,

or in the warfighters having to resort to riskier contingency plans to carry out their missions, which increased the likelihood of mission failure and casualties. In this business, data quality matters.

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V. CONCLUSIONS AND RECOMMENDATIONS

In conclusion, this study provides insight into how the JMC can significantly improve data quality in its component organizations. Based on the data analyzed in this thesis, there must be a strategic focus on improving training and policy formulation. Furthermore, the JMC must invest effort into the development of solid internal processes for supporting training and policy management since processes appear to have an indirect impact on data quality within the LMP.

A. TRAINING RECOMMENDATIONS

As this study has shown, the training approach provided by the Army was inadequate. The fact that subsequent audits showed significant reductions in data defects suggests that alternative forms of training must have occurred within the various components of the JMC. It is therefore recommended that the Army adopt learner-centric training strategies and utilize them to educate new users of the LMP, as well as to meet the training needs of users with varying levels of experience. The training program should be fully compliant with the concepts of the *ALC 2015* (TRADOC, 2011) strategy that was discussed in Chapter II.

B. POLICY RECOMMENDATIONS

One particularly troublesome aspect of policy defects is that no matter how well the users are trained, a shifting policy, a poor policy, or a formerly good policy that no longer serves the interests of the mission based on changing conditions can have a hugely negative impact on data quality. Based on the findings of this study, the JMC must be vigilant in defining, implementing, communicating, and maintaining its policies related to the usage of the LMP. With so many components and subcomponents, it would be very easy for the JMC to become parochialized regarding the LMP. A stovepiped approach would undermine its effectiveness.

C. PROCESS RECOMMENDATIONS

In order to carry out the training and policy recommendations they must each be undergirded with solid processes. The training processes that the JMC should develop must be apt at assessing the training needs of the LMP users and systematically delivering them knowledge that is both accurate and pertinent to their jobs on a timely basis and in a manner that adapts to the individual user's learning capability. Likewise, the JMC should create processes that support sound policy management. Policy processes should require the thorough review of the impacts of adopting a proposed policy as well as the consequences of rejecting it. Processes that promote comprehensive policy reviews should minimize the need for policy changes. However, when the inevitable need for a change occurs, there should be a policy change control process for ensuring that the change is executed in a manner that does not create defective data.

D. FINAL THOUGHTS

As more audits are conducted, the author hopes that this study will encourage an effort to discover more opportunities for reducing data defects within the LMP. It is possible that three categories of qualification is too simplistic and that more defect categories are necessary. As more audit data is captured, and more analysis is conducted, time will tell.

On a final note, the LMP is the system by which the JMC conducts its business. Because of the potential downstream effects in terms of money and human lives, the data quality within this system is profoundly important. By drawing attention to the importance of data quality, this study makes it possible for the Army to improve its support of the warfighter.

APPENDIX

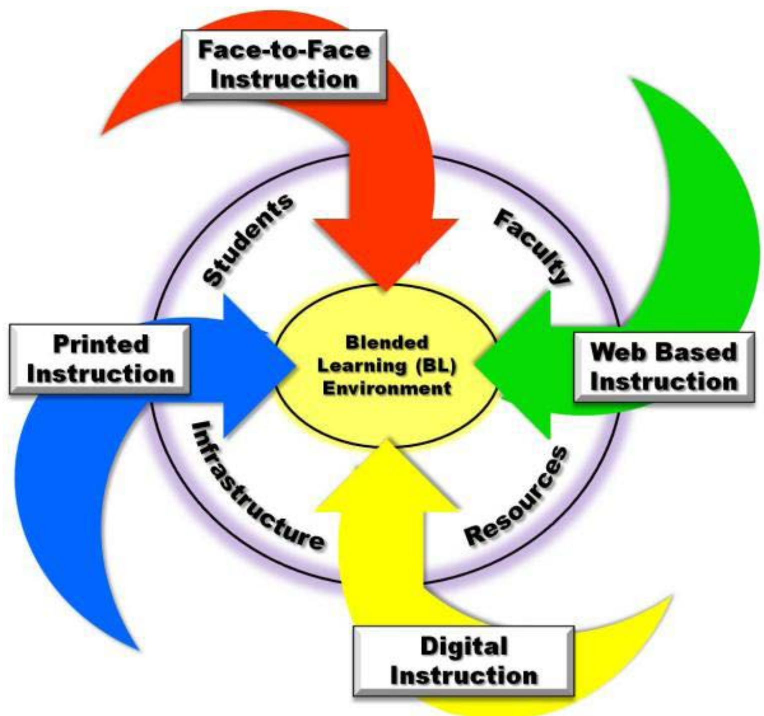

Figure 8. Blended Learning Environment (From: Plifka, 2011, p. 23)

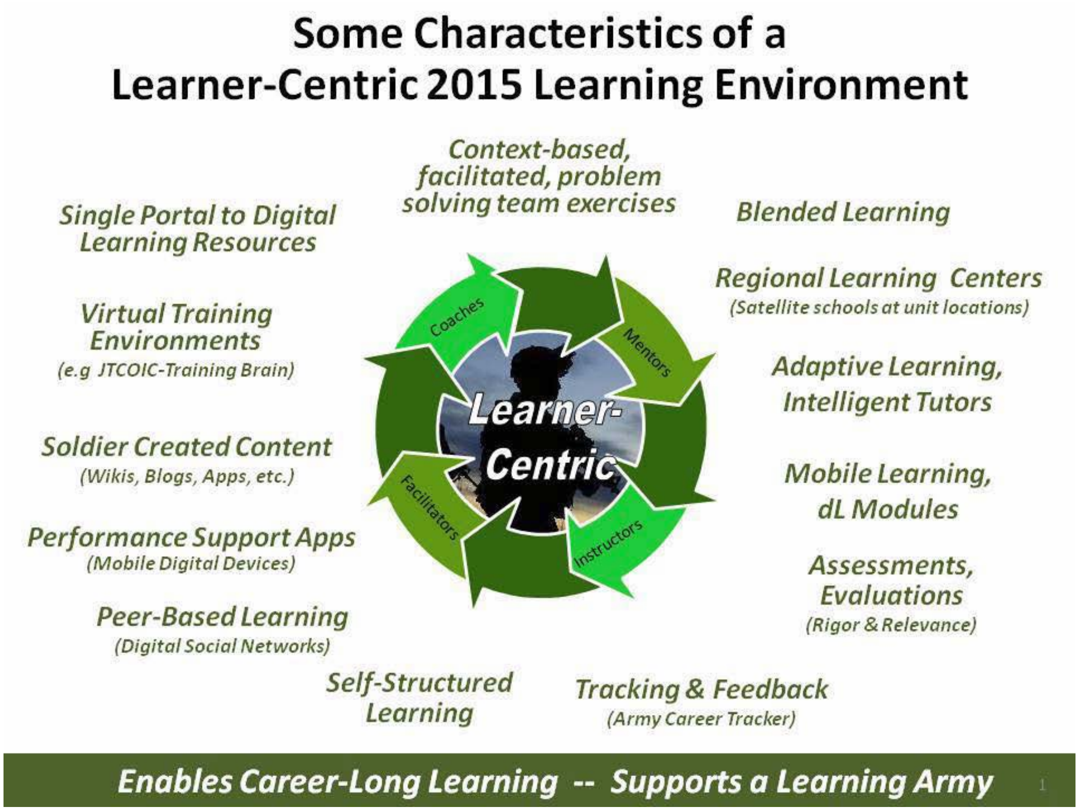

Figure 9. Learner-Centric 2015 Learning Environment (From: TRADOC, 2011)

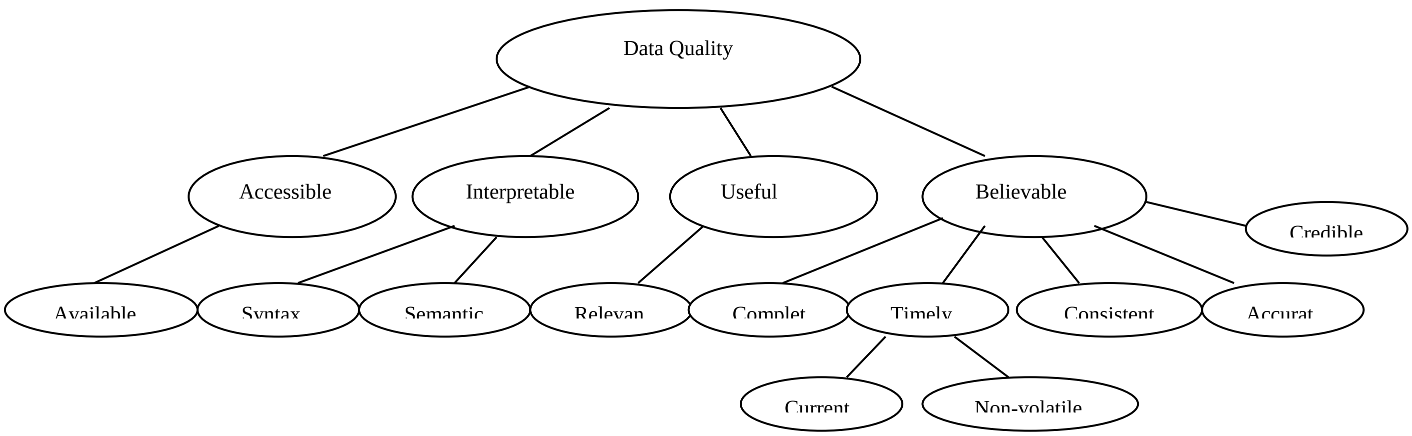

Figure 10. A Hierarchy of Data Quality Dimensions (After: Wang et al., 1992, p. 3)

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LIST OF REFERENCES

Bearden, R. (2012). Pine Bluff Arsenal. In *The Encyclopedia of Arkansas history & culture*. Retrieved from http://encyclopediaofarkansas.net/encyclopedia/entry-detail.aspx?entryID=2927

Blue Grass Army Depot (BGAD). (n.d.). *Blue Grass Army Depot* [Brochure]. Retrieved from http://www.bluegrass.army.mil/Info/BGAD%20Brochure.pdf

Butler, J. (1998, July). A history of information technology and systems. Retrieved from http://www.tcf.ua.edu/AZ/ITHistoryOutline.htm

Caterinicchia, D. (2002, November). Army logistics marches ahead. Retrieved from http://www.fcw.com/fcw/articles/2002/1118/pol-army-11-18-02.asp

Chairman of the Joint Chiefs of Staff (CJCS). (1997). *Joint vision 2010*. Washington, DC: Office of the Chairman.

Crane Army Ammunition Activity. (n.d.-a). About Crane Army Ammunition Activity. Retrieved from http://www.crane.army.mil/pa/history.html

Crane Army Ammunition Activity. (n.d.-b). Letterkenny Munitions Center. Retrieved from http://www.crane.army.mil/pa/lemc.html

Department of the Army. (2007, August 3). *Army training and leader development* (Army Regulation 350-1). Washington, DC: Author.

Department of the Army. (2010, August 19). *The United States Army operating concept: 2016–2028* (TRADOC Pamphlet 525-3–1). Fort Monroe, VA: Author.

Government Accountability Office (GAO). (2010, April). *Defense logistics actions needed to improve implementation of the Army logistics modernization program* (GAO-10-461). Retrieved from http://www.gao.gov/products/GAO-10-461

Government Accountability Office (GAO). (n.d.). About GAO. Retrieved from http://www.gao.gov/about/index.html

Hill, C. W. (2007, September). *Transforming the force: A comparative analysis of the Department of Defense's (DOD's) enterprise resource planning (ERP) systems*. Unpublished master's thesis, Naval Postgraduate School, Monterey, CA.

Joint Munitions Command (JMC). (2012, February 27). Joint Munitions Command history. Retrieved from http://www.jmc.army.mil/Historian/JMCHistory.aspx

LMP Special Project Team. (2004). *The business case: Wholesale logistics modernization program*. Fort Belvoir, VA: U.S. Army CECOM.

Means, B., Toyama, Y., Murphy, R., Bakia, M., Jones, K. (2010). *Evaluation of evidenced-based practices in online learning: A meta-analysis and review of online learning studies*. Washington, DC: Department of Education.

McAlester Army Ammunition Plant (MCAAP). (n.d.). Products and services. Retrieved from http://www.mcaap.army.mil/PNS/PNS.aspx

Office of the Secretary of Defense (OSD). (1997a, May). *Quadrennial defense review report*. Washington, DC: Department of Defense.

Office of the Secretary of Defense (OSD). (1997b). *Defense reform initiative*. Washington, DC: Author.

Plifka, J. (2011). *Blended learning: The Army's future in education, training, and development* (Master's thesis, U.S. Army War College). Retrieved from http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA560138

Tooele Army Depot. (n.d.). Tooele Army Depot's vision/mission statement. Retrieved from http://www.tead.army.mil/

United States Army Training and Doctrine Command (TRADOC). (n.d.). About TRADOC. Retrieved from http://www.tradoc.army.mil/About.asp

United States Army Training and Doctrine Command (TRADOC). (2011). *The U.S. Army learning concept for 2015* (TRADOC Pam 525-8-2). Retrieved from http://www.tradoc.army.mil/tpubs/pams/tp525-8-2.pdf

Vandana, S. (2003, April). Federal IT is stable despite changes. Retrieved from http://www.gcn.com/print/22_8/21733-1.html

Wallace, T. F. (2001). *ERP: Making it happen: The implementer's guide to success with enterprise resource planning*. New York, NY: Wiley.

Wang, R. Y., Reddy, M. P., & Kon, H. B. (1992). *Data quality requirements analysis and modeling*. Retrieved from http://archive.org/details/dataqualityrequi92wang

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